CLAIMS

1. A device for sealing or tightly closing bottles (1) or similar containers, characterized in that it has at least two elements that are stably held together, i.e. a rigid capsule (3), having a hollow revolution shape, that is a cup shape, resulting from a hollow cylinder or truncated cone with a closed bottom, which is made from metal, plastic or other material having similar properties, and an extensible plastic diaphragm (2), which is permanently subtended over the rim of the open side of the rigid capsule (3), or preferably subtended perpendicular to the axis of the cylinder or truncated cone in any suitable manner in a plane situated between the closed bottom and the opening of the capsule (3). As the device is fitted on the opening of the container (1), said diaphragm is stretched and caused to tightly adhere against the edge of the opening. Moreover, the cylinder or truncated cone-shaped wall has means (101) for coupling it, by deformation or screw fastening, to cooperating radial ridges or external threads of the end portion of the opening of the container (1), and seal means (4) interposed between the closed bottom of the capsule and the edge of the opening of the container (1).

2. A device as claimed in claim 1, characterized in that the diaphragm may be secured to the rigid cup-shaped element, i.e. the capsule (3), in several different manners, i.e. either by gluing or by other chemical and/or physical adhesion arrangements.

3. A device as claimed in claim 1 or 2, characterized in that the diaphragm (2) may be secured to the rigid cup-shaped element, i.e. the capsule (3), by directly attaching it to the edge that surrounds the opening of the cup-shaped element, i.e. the capsule (3).

4. A device as claimed in claim 3, characterized in that the edge that surrounds the opening of the rigid cup-shaped element, i.e. the capsule (3) may be widened in such a manner as to form an enlarged and/or thickened portion or a flange, which provides a wider surface for adhesion of the diaphragm (2).

5. A device as claimed in one or more of the preceding claims, characterized in that the diaphragm (2) extends radially beyond said edge and forms an annular peripheral surface which is designed to adhere against the end portion of the outer cylindrical or truncated cone-shaped wall of the cup-shaped element, i.e. the capsule (3), adjacent to the open end thereof.

6. A device as claimed in claim 5, characterized in that the annular peripheral band of the diaphragm (2) tightly adheres against the outer surface of the cup-shaped element, i.e. the capsule (3), thanks to the natural resiliency properties of the diaphragm (2).

7. A device as claimed in one or more of the preceding claims, characterized in that the plastic elastomeric diaphragm (2) is positioned on a bushing (11) or a cylindrical ring nut, which is open on both end sides and has such an inside diameter that, when the diaphragm (2) is subtended over the opening of the

cup-shaped element, i.e. the rigid capsule (3), with the annular peripheral band of said diaphragm (2) overlapping to a certain extent the outer surface of the cylindrical wall of the cup-shaped element, or the capsule (3), the bushing (11) or ring nut lies, thanks to an elastic and/or shape fitting arrangement, over the rigid cup-shaped element (3), along a portion of its axial extension, from the end of the opening of the cup-shaped element (3), thereby compressing the peripheral band of the diaphragm (2) against the outer surface of the cylindrical wall of the rigid cup-shaped element (3).

8. A device as claimed in one or more of the preceding claims, characterized in that the ratio of the diameter of the rigid cup-shaped element (3) to the diameter of the bushing (13) or ring nut is such that the bushing (13) penetrates the inner surface of the peripheral wall of the cup-like element (3), along a certain axial depth, thereby compressing the annular peripheral band of the diaphragm (2) which overlaps the outer surface of the bushing (13) or ring nut against the inner surface of the cylindrical wall of the rigid cup-shaped element (3).

9. A device as claimed in claim 7 or 8, characterized in that subsequent welding or simultaneous gluing may be also provided.

10. A device as claimed in one or more of claims 7 to 9, characterized in that the bushing (11) or (13) or ring nut may have lead-in surfaces, which may consist, if the bushing or ring nut is designed to be force

fitted in the cup-shaped element (3) of a conical or rounded tapering of the insertion end.

11. A device as claimed in one or more of claims 7 to 10, characterized in that the diaphragm (2) is embedded in the assembly of the rigid cup-shaped element (3) and the bushing (13) or ring nut.

12. A device as claimed in one or more of the preceding claims, characterized in that the bushing (11) or ring nut and the rigid cup-shaped element (3) are connected by means of radial ridges of one of the two elements, cooperating with radial recesses of the other element, which radial recesses may be provided originally or formed by deformation by the radial ridges of the other part, upon coupling thereof.

13. A device as claimed in one or more of the preceding claims, characterized in that, in combination with the rigid cup-shaped element (3), an element (82) is provided, which is made of an elastomeric material, and also has a cup shape, and whose cylindrical wall is designed to come in contact with the inner surface of the cylindrical or truncated-cone shaped wall of the rigid cup-shaped element (3), said rigid cup-shaped element (3) being axially deeper than the elastomeric cup-shaped element (82) which is to act as an extensible diaphragm.

14. A device as claimed in claim 13, characterized in that the extensible plastic element (82), preferably made by injection molding, and having the shape of a cup with a peripheral rim, i.e. a thicker and/or stiffer ring, is shaped like a hollow closed-bottom

body of revolution having an appropriate thickness.

15. A device as claimed in one or more of the preceding claims, characterized in that the free edge of the extensible plastic cup-shaped element (82) has a stiffening flange or annular widened portion (85) of any suitable shape, and made of the same material, whereas the inside diameter of said flange or enlarged portion preferably corresponds to the inside diameter of the rigid cup-shaped element (3) minus twice the thickness of the cylindrical portion of the element (82), and the outside diameter is equal to or greater than the outside diameter of the outer cylindrical wall of the or rigid cup-shaped element (3), and its thickness is sufficient to stiffen the edge.

16. A device as claimed in one or more of the preceding claims, characterized in that the rigid cup-shaped element (3) has a cylindrical or substantially cylindrical or a conical or substantially conical shape and may have an annular seat (84) for the stiffened rim (83).

17. A device as claimed in one or more of the preceding claims, characterized in that the rigid cup-shaped element is made of plastic or metal or combinations of said materials.

18. A device as claimed in one or more of the preceding claims, characterized in that the rigid cup-shaped element (3) has a sealing element (4), such as a disk or the like, between the diaphragm (2) and the closed bottom.

19. A device as claimed in claim 18, characterized

in that the sealing element is pre-fitted in the inner bottom of the rigid cup-shaped element (3).

20. A device as claimed in one or more of the preceding claims, characterized in that the rigid cup-shaped element (3) has at least one aperture (9) formed in its closed bottom, which is tightly closed by a transparent wall (8) and extends over a portion or the whole of the surface of said bottom.

21. A device as claimed in claim 20, characterized in that the transparent wall element (8) for tightly closing the aperture (9) is also used as a seal and is secured to the rigid cup-shaped element (3) by gluing or welding or other chemical and/or physical adhesion arrangements.

22. A device as claimed in one or more of the preceding claims, characterized in that the rigid cup-shaped element (3) has a sealing ring attached to its open edge, which is held to the rest of the rigid cup-shaped element (3) by a tear-off line, requiring a predetermined breaking force, and provides snap engagement by elastic force fitting thereof on the container or by shrinking thereof on the opening of the container (1) by cooperating with at least one retaining shoulder situated at a predetermined axial distance from the edge of the opening of the container (1).

23. A device as claimed in one or more of the preceding claims, characterized in that when the rigid cup-shaped element (3) is fitted on the opening of the container (1) it extends to a certain extent beyond the

free edge of the container (1) thereby forming a drinking cup or glass element (301).

24. A device as claimed in claim 23, characterized in that the extension (30) of the rigid cup-shaped element (3) is shaped and has such a diameter that its free edge substantially abuts or adheres against the outer surface of the container (1).

25. A device as claimed in claim 23 or 24, characterized in that the extension (30) is made of one piece with the rigid cup-shaped element (3).

26. A device as claimed in claim 23 or 24, characterized in that the end portion of the skirt wall (30), associated to the rigid cup-shaped element (3) has a shape (34) that is complementary to that of said rigid cup-shaped element (3), whereby said end portion forms a closed glass bottom that has such a size as to be able to be force fitted and/or coupled by chemical and/or physical adhesion arrangements to the rigid cup-shaped element (3).

27. A device as claimed in one or more of the preceding claims 23 to 26, characterized in that the free edge of the skirt wall (30) that forms the extension of the rigid cup-shaped element (3) whose shape mates the shape of the container (1) is covered and protected by a label (32) that overlaps both the container (1) and partly a portion of the wall of said extension (30)

28. A device as claimed in one or more of the preceding claims, characterized in that a plate, a disk (33) or similar is provided outside the closed bottom

of the rigid cup-shaped element (3), for forming the base foot of the drinking glass (30), whose diameter is preferably greater than that of the rigid cup-shaped element (3).

29. A device as claimed in one or more of the preceding claims, characterized in that the rigid cup-shaped element (3) has a sealing end ring (36) which extends all along the free edge of the open side of said rigid cup-shaped element (3), which ring (36) is separated from the rest of the rigid cup-shaped element (3) by a tear-off line, requiring a predetermined breaking force, and which ring (36) is designed to engage by snap engagement and/or crimping behind a continuous or discontinuous outer radial annular shoulder (35) of the container (1), which shoulder is situated at such a distance from the edge of the opening that, when the container is perfectly closed, the ring (35) is engaged on the container, whereas the extension of the rigid cup-shaped element (3) that forms the drinking glass extends toward the bottom of the container (1) in such a shape and for such an axial length as to lie over and beyond the sealing ring (32) and as to generate such a small annular interstice with the container wall as to prevent any access, by hand or other tools, to the sealing ring (35) itself.

30. A device as claimed in one or more of the preceding claims, characterized in that a drinking glass element (31) is provided, whose shape is complementary to the bottom of the container (1), and allows it to be coupled to said bottom of the container

(1) by slight elastic force fitting, the skirt wall of said drinking glass element (31) having such a length that a label (32) lies over the free edge of said drinking glass element (31) at least along an end portion of said free edge.

31. A device as claimed in one or more of the preceding claims, characterized in that it has both a drinking glass element (30) associated to the rigid cup-shaped element (3) and a drinking glass element (31) associated to the bottom of the container (1), the free edges of both drinking glass elements being covered by the label (32) of the container.

33. A process for making a metal truncated cone-shaped capsule as claimed in one or more of claims 1 to 6, characterized the steps of:

firmly holding the rigid cup-shaped element (3) from the side opposite to the open side to be closed by the diaphragm (2), preferably by using an electromagnet (37) which comes in contact with the rigid cup-shaped element (3) of the capsule from the outside of the closed side thereof;

Pushing the rigid cup -shaped element (3) into a cylindrical hole or an aperture having an appropriate diameter, along the axis of said rigid cup-shaped element (3) and/or of the cylindrical hole, an extensible plastic diaphragm (2) being subtended over the opening of said hole, in any suitable manner.

Stretching the diaphragm (2) with the help of the free edge of the rigid cup-shaped element (3) upon penetration thereof in the cylindrical hole and/or

passage thereof through the cylindrical hole, which diaphragm (2) will take, due to its internal transverse stresses, the shape of a paraboloid of revolution.

Cutting the diaphragm (2) all around the rigid cup-shaped element (3), for instance by using a sharp annular blade (38), placed at a certain distance from the hole and behind it, by using the same pressure force of the rigid cup-shaped element on the diaphragm (2), which annular blade 38 is overhanging and integral with the inside of the cylindrical hole, whose diameter is greater than the outside diameter of the rigid cup-shaped element (3) and smaller than that of the cylindrical hole.

Whereas, due to the transverse resilient stresses caused by longitudinal stretching of the extensible plastic polymer, the edge cut from the diaphragm (2) shrinks around the outer surface of the free edge of the rigid cup-shaped element (3), its diameter becoming smaller than the greatest diameter of the truncated cone-shaped rigid cup-shaped element (3), and is finally locked in position.

34. A process for making a composite capsule as claimed in claim 11, characterized in that a diaphragm disk (2), whose diameter is greater than the inside diameter of the capsule (3) is first made to coaxially adhere by vacuum to the closed, suitably perforated bottom of a hollow cylinder (21) whose inside diameter is smaller than the inside diameter of the capsule (3) to be later forced into the capsule (3) and caused to adhere thereto, by the portion of the diaphragm disk

(2), which exceeds the diameter of the cylinder (21), along a cylindrical portion, next to the free edge of the capsule (3).

35. A process as claimed in claim 34, characterized in that the hollow cylinder (21) is replaced by a hollow truncated cone having a closed bottom whose smaller diameter is suitably perforated.

36. An apparatus or tool for implementing the process as claimed in claim 34, characterized in that it consists of a modular cylinder (21), i.e. composed of several parts, whose outside diameter is smaller than the inside diameter of the capsule (3), said modular cylinder (21) being longitudinally divided into at least two sectors (27) which have a 180° angular width, are hollow and equal, have a closed bottom and may be transversely spread apart by pneumatic cam actuators, e.g. by pistons (28) and cylinders (28bis) appropriately arranged between the sectors (27) or by inflatable bags, whereas they may be drawn closer by suitable springs, e.g. annular springs that outwardly and inwardly surround the sectors (27) of the modular cylinder (21).

37. An apparatus as claimed in claim 36, characterized in that each hollow sector (27) of the cylinder (21) is maintained under vacuum and has at least one hole in its closed bottom for communication with its inner cavity.

38. An apparatus as claimed in claim 36 or 37, characterized in that it has mechanical drive means that accomplish the steps of grasping the diaphragm

disk (2), introducing it in the rigid cup-shaped element (3) and then pressing the portion thereof that exceeds the diameter of the cylinder (21) against the inner cylindrical portion of the rigid cup-shaped element (3), provided for adhesion.

39. A process for making the capsule as claimed in claim 11, wherein the open side of the rigid cup-shaped element (3) is first flared by a conical wedge (14) and later flattened by a flat head cylinder (15), whereas the rigid cup-shaped element (3) is held by vacuum (20) in a correspondingly shaped housing (16), and a diaphragm disk (2) is laid on the plane of the portion that is bent at 90° with respect to the cylinder axis, in any suitable manner, whereupon the flattened edge, with the diaphragm (2) fitted thereon is brought back to its original position by a first bend back step, and subsequently straightened by rolling it by suitable rollers 17 and counter rollers 18 and/or by a coaxial compression of conical sectors 19, which are connected to form a sort of mandrel.

40. A process as claimed in claim 34 or 39, for maling the composite capsule as claimed in claim 11, characterized in that the steps of flaring, flattening, fitting the diaphragm disk (2) and subsequently restoring the position of the bent portion is carried out on the rectangular or trapezoidal surfaces delimited by the cuts (12) formed in the cylindrical walls of the capsule (3), on which the diaphragm (2) adheres.

41. A process as claimed in claim 39,

characterized in that the steps of flaring or flattening the free edge of the capsule (3) at 90° is obtained by spin molding the capsule (3) from a ductile metal.

42. A process as claimed in claim 41, characterized in that a metal pellet is introduced in an appropriate openable mold and forced by spinning to spread through the whole space in the mold, the steps as claimed in claim 41 being carried out later on.